

FREEDOM-TO-MIX: Integrating Strategic Offensive and Defensive Arms Control

The United States and Russia appear to be on divergent paths with respect to the ABM Treaty. While both nations have formally affirmed their commitment to this treaty, the United States is developing technologies to support a deployment of national missile defenses within a rolling three-year timeframe. In addition there are strong voices in the Congress calling for moving as soon as possible beyond technology development to actual deployment. Meanwhile, Russia remains adamant that the ABM Treaty be preserved and has emphasized that progress in strategic arms reductions is conditioned on the continuation of the ABM Treaty.

This presentation explores an intriguing possibility for averting a situation where the United States is ultimately forced to choose between maintaining the ABM Treaty and deploying effective national missile defenses. Under the “freedom-to-mix” concept both the START and ABM treaties would be subsumed within a single new treaty. This freedom-to-mix treaty would have an overall limit on the total of strategic offensive plus defensive systems, with each nation having the freedom to decide its own separate subtotals of offensive and defensive systems.

The presumptive advantages of such a treaty are that it would allow the United States to deploy defenses beyond the limits of the ABM Treaty while allowing Russia to maintain a formal parity with the United States. This presentation critically examines the validity of these presumptions as well as other policy and technical issues associated with the freedom-to-mix concept.

Freedom-to-Mix
A Concept for Integrating
Strategic Offensive and Defensive Arms Control

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United States Department of State
Arms Control Bureau
Office of Technology and Analysis

The US and Russia Have Diverging Views on the ABM Treaty

- The United States is moving toward possible withdrawal from the ABM Treaty
 - Evolving national security priorities
 - Decreasing concern with Russian intentions and capabilities
 - Increasing concern with the ballistic missile threat from third nations
 - Improving national missile defense technologies

- Russia remains adamant that the ABM Treaty be preserved
 - The ABM Treaty is the cornerstone of the US/Russian strategic relationship
 - Promotes stability and parity
 - Avoids an offensive/defensive arms race
 - The ABM Treaty underpins the entire bilateral arms control edifice
 - Russia is ill-prepared to engage in an offense/defense competition

These views are becoming increasingly difficult to reconcile, especially as strategic inventories are reduced

The Freedom-to-Mix (FTM) Concept

- What is it?
 - US and Russia would negotiate a limit on the total number of strategic offensive plus defensive forces
 - Each side would determine its own mix of offensive and defensive forces under that limit
- Why consider it?
 - US could deploy defenses beyond the current limits of the ABM Treaty to protect against limited attacks
 - Russian concerns about parity and stability might be allayed

Freedom-to-Mix could allow the US to deploy limited NMD without putting at risk existing and prospective agreements

The Bottom Line

- Will FTM allow the US to deploy limited NMD?
 - Yes
- Will FTM allow Russia to maintain “parity” with the US?
 - Yes
- Will FTM help allay Russia’s concerns about stability?
 - Probably not
- Should we pursue FTM?
 - It depends. Pursue FTM if:
 - (a) US prefers FTM to ABM Treaty withdrawal
 - (b) Russia prefers FTM to modifying the ABM Treaty

Topics

- Freedom-to-Mix Issues
 - Parity
 - Predicting Force Mixes
 - Offense-Defense Exchange Ratio
 - Timing
 - Air Defenses
 - Multilateralization of START
 - Alternative Contexts for NMD
- Three Key Questions
 - What levels of defenses are needed to defeat small attacks?
 - Do defenses designed against small attacks help or harm deterrence and stability?
 - Does Freedom-to-Mix ameliorate or exacerbate harm to deterrence and stability?
- Observations and Conclusions

Parity

- Strict parity in either offensive arms or defensive arms has not been an impediment to past agreements or actions
 - SALT I limits
 - Asymmetric ABM deployments
 - Asymmetric strategic forces under START
 - START II ceiling of 3000 - 3500
- Freedom-to-mix requires a broader definition of parity that encompasses both offensive and defensive forces
 - No current metric

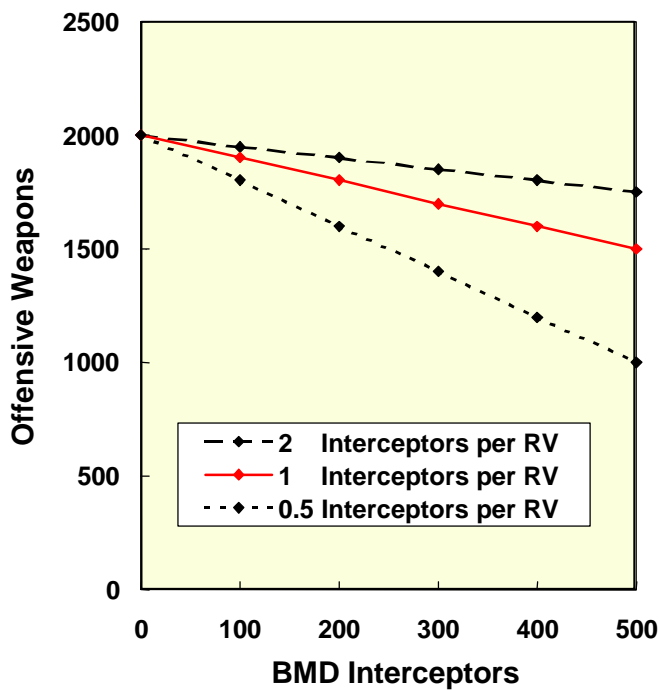
It may prove difficult to develop a metric for comparing combined offensive and defensive forces

Predicting Force Mixes

- The US might *not* exploit its “freedom” to mix
 - Plans can change
 - Developed but never deployed: B-70, SICBM
 - Deployed at lower levels than planned: B-2, Peacekeeper
 - Deployed but rapidly withdrawn: Safeguard
 - Reducing offensive systems could provoke strong resistance within the US
- Russia *might* deploy significant defenses
 - Ballistic missile threat from countries other than the US
 - Traditional emphasis on defenses
 - Nuclear-tipped defenses less technically challenging

The predictability of both sides’ forces will decrease under freedom-to-mix

Offense-Defense Exchange Ratio



- More than one defender per RV helps compensate for
 - Imperfect interceptor SSPK
 - Limited footprint
- Less than one defender per RV helps compensate for
 - Low day-to-day alert rates
- One defender per RV
 - May be a good compromise
 - Has the appeal of simplicity

The smaller the expected deployment of defenses, the more tolerable an unfavorable exchange ratio

Timing

- | | |
|--|---|
| <ul style="list-style-type: none">• Incorporate into START III negotiations<ul style="list-style-type: none">– We need defenses ASAP– More “trade space” to exchange offenses for defenses– Greater negotiating leverage | <ul style="list-style-type: none">• Negotiate later (or never)<ul style="list-style-type: none">– Defenses aren’t developed– Uncertain deployment decisions– Don’t complicate START III |
|--|---|

The timing issue is driven by the perceived need for, and availability of, national missile defenses

Air Defenses

- Incorporating air defense presents numerous technical problems
 - Complex analysis required to assess penetrability of air weapons
 - Air defense interceptors difficult to distinguish from other aircraft
 - Mobile SAMs difficult to count/verify
 - BMD/TMD/air defense demarcations problematic
- The United States is unlikely to want to include air defenses in a freedom-to-mix agreement
 - Air defenses are currently unconstrained
 - Air defenses are useful against rogue cruise missiles

There appears to be little incentive to include air defenses in a freedom-to-mix agreement

Multilateralization of START

- An FTM agreement satisfactory to two parties may not generalize to three or more parties
- Other nations have only limited capabilities to deploy effective defenses, so they will not be able to take advantage of FTM
- With other nations' offensive arsenals smaller than those of the United States and Russia, concern about limited US and Russian defenses could be greater

FTM is unlikely to foster multilateralization of strategic arms control

Alternative Contexts for NMD

NMD Context	Advantages	Disadvantages
Keep ABM Treaty Limits	<ul style="list-style-type: none"> • Useful against errant Russian missile launches • Provides valuable operational experience 	<ul style="list-style-type: none"> • Not effective against rogue nations
Withdraw from ABM Treaty	<ul style="list-style-type: none"> • No negotiation necessary • No constraints on NMD testing or deployment 	<ul style="list-style-type: none"> • Uncertain impact on bilateral arms control • Uncertain impact on Russian forces • Uncertain reaction of others
Modify ABM Treaty	<ul style="list-style-type: none"> • Russian cooperation achieved • Constrains NMD to specified limits 	<ul style="list-style-type: none"> • Russian cooperation required • Limits will represent a compromise • Limits might ultimately prove problematic

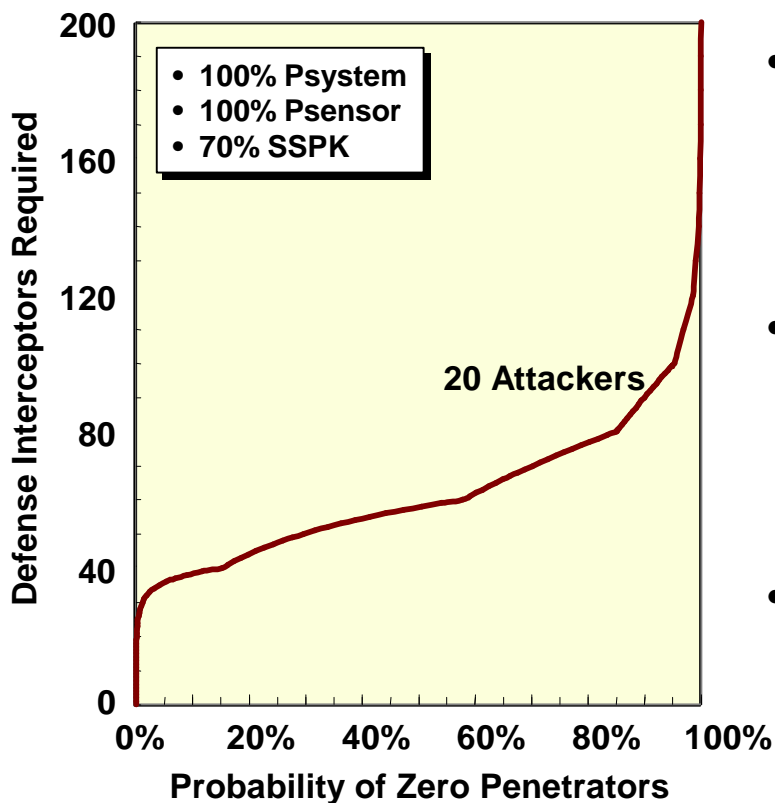
Freedom-to-Mix should be explored because all of the alternatives have marked disadvantages

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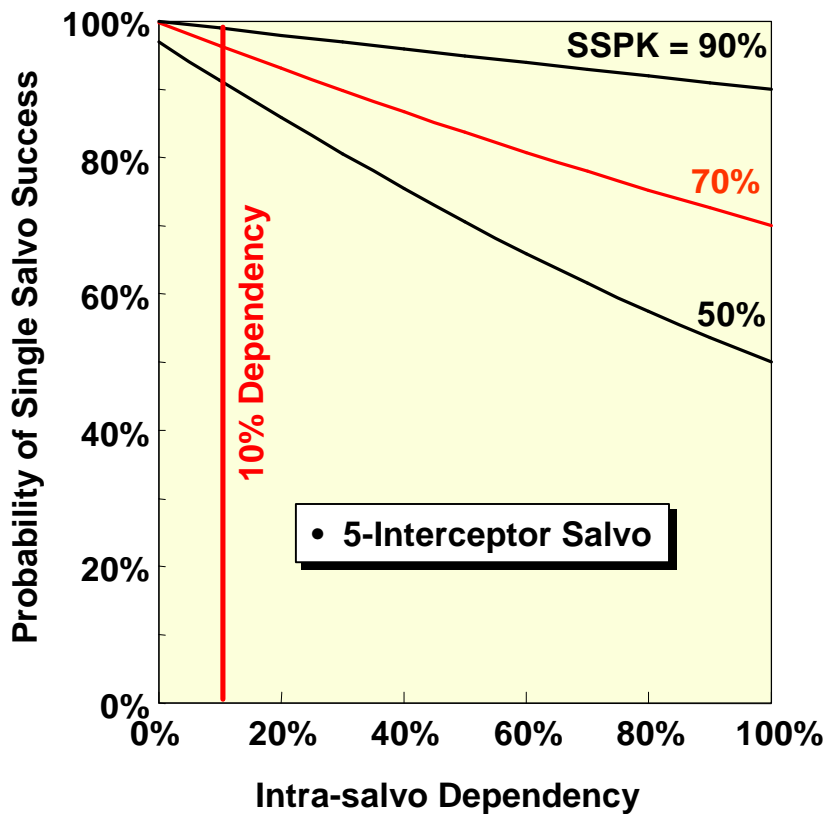
NMD Interceptors Required

Binomial Analysis



- Binomial analysis indicates that very high confidence of zero penetrators requires over 90 interceptors for 20 attackers
- But, binomial modeling assumes
 - Interceptor engagements are independent
 - P_k is known
- Binomial modeling represents a lower bound on required interceptors

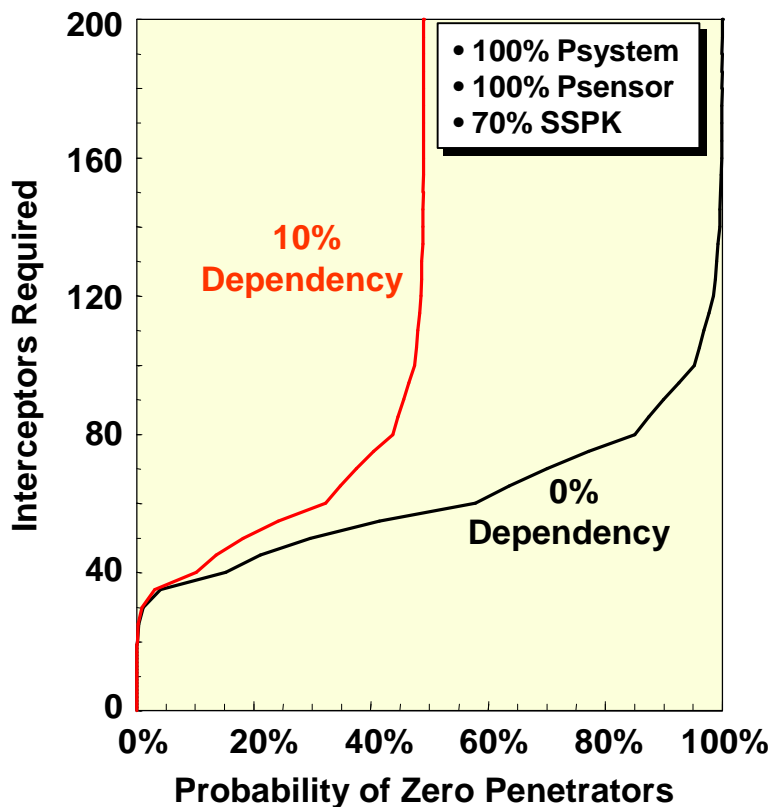
Effect of Dependency of Engagements on Single Salvo Success



- Intra-salvo dependency reduces the effectiveness of a salvo
- In the limit of no dependency, binomial analysis is valid
- In the limit of complete dependency, all engagement outcomes are identical
- The effect of intra-salvo dependency is greatest at intermediate P_k 's

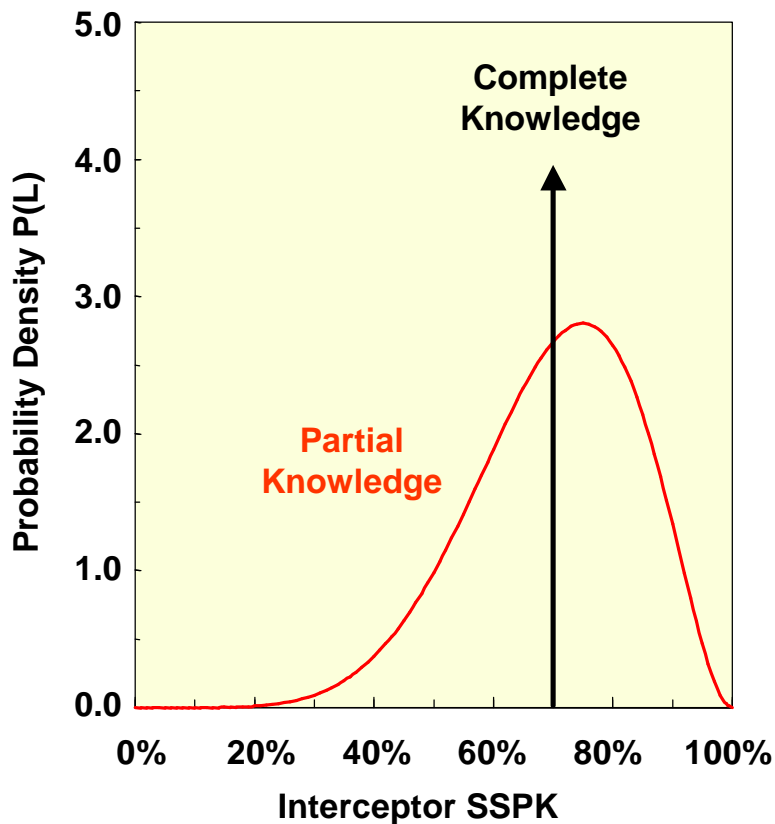
Sensitivity to Intra-Salvo Dependency

20 Attacking RVs



- Even low intra-salvo dependency precludes achieving high confidence of zero penetrators
- More than ~100 interceptors will not significantly increase defense effectiveness against 20 attackers

Interceptor SSPK is *Not* Known Precisely

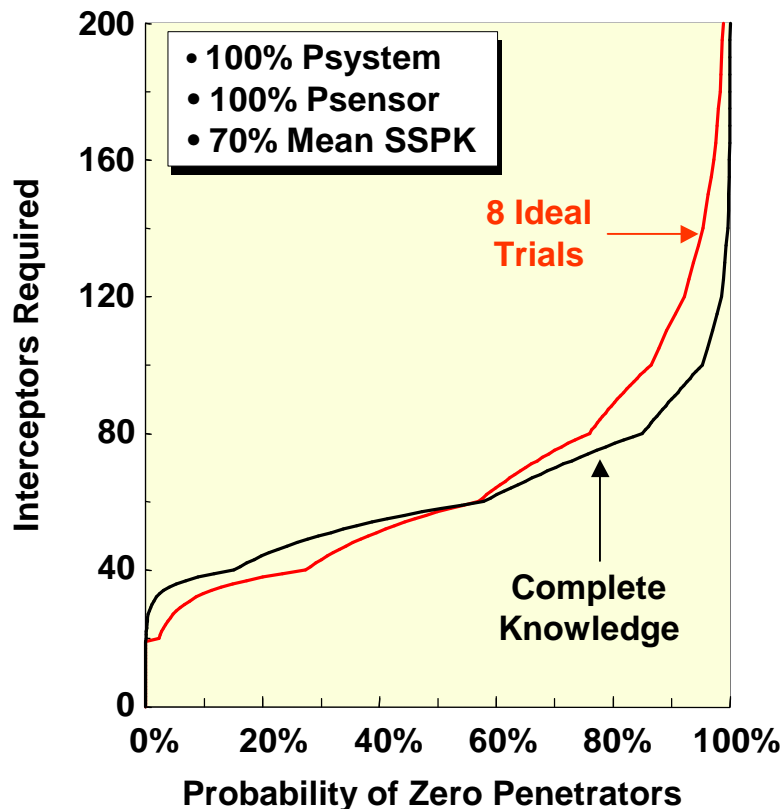


The Limits of Knowledge

- Uncertainty in RV characteristics and trajectory
- Complex system interactions
- Two-sided situation
- Simulations and modeling insufficient
- Flight testing expensive
- Analogies of limited relevance
- National missile defenses can't be battle-tested

Sensitivity to Uncertainty in SSPK

20 Attacking RVs



- Uncertainty in P_k significantly increases the number of interceptors required for high confidence of zero penetrators
- At low probabilities of zero penetrators, uncertainty in P_k can *reduce* the number of interceptors required

Question 1: What Levels of Defenses are Needed to Defeat Small Attacks?

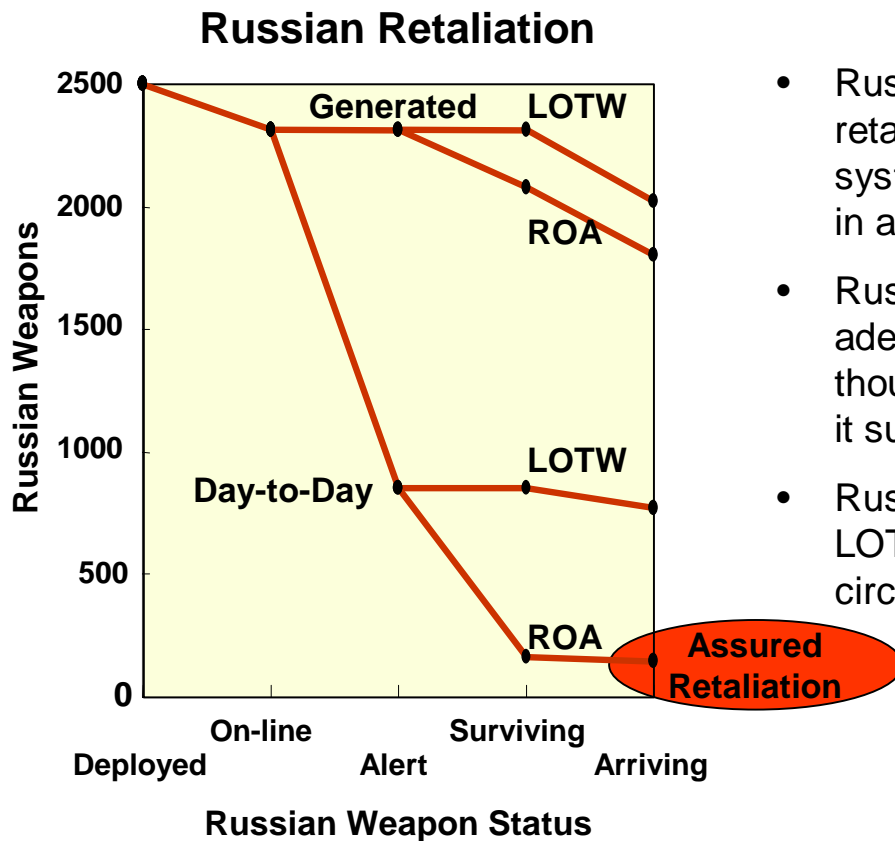
- Interceptor requirements are highly sensitive to
 - Defense performance goals
 - Attack size
 - Required probability of zero penetrators
 - Threat range
 - Defense design
 - Intra-salvo dependency
 - Footprint
 - Number of independent layers
 - Interceptor single-shot probability of kill (SSPK)
 - Uncertainty in interceptor SSPK

**If achievable at all, defenses highly effective against 20 RVs
could require up to 300 interceptors per site**

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Russian Deterrence



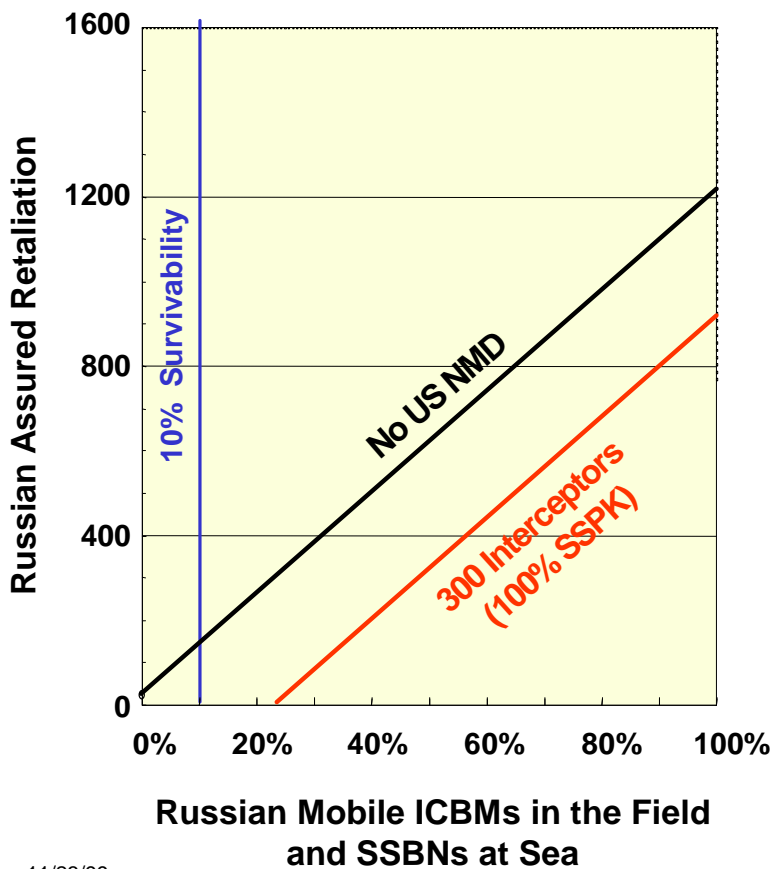
- Russia's relatively low assured retaliation is due to few systems deployed day-to-day in a survivable basing mode
- Russia is concerned with the adequacy of its deterrent, even though the US is likely to judge it sufficient
- Russia currently relies on LOTW and early generation to circumvent this problem

Effect of Limited Defenses on Russia's Deterrent

- Russia will likely make the conservative planning assumption that US interceptors are perfect
 - Respect for US technology
 - Intelligence & transparency limits
 - Worse-case analysis
- US national missile defenses, *whatever the context for their deployment*, will undermine Russia's deterrent
 - US defenses of about 100 interceptors designed against limited attacks of about 20 RVs could adversely and substantially affect Russian assured retaliation
 - Russia could believe that the US could support a first-strike option with fewer than 200 NMD interceptors

US national missile defenses will undermine Russia's deterrent

Russian Force Posture Options to Restore its Deterrent



- Russia can restore its deterrent by moderately increasing its survivable alert forces
- But Russia will still have incentives for early generation and LOTW

Question 2: Do Defenses Designed Against Small Attacks Help or Harm Deterrence and Stability?

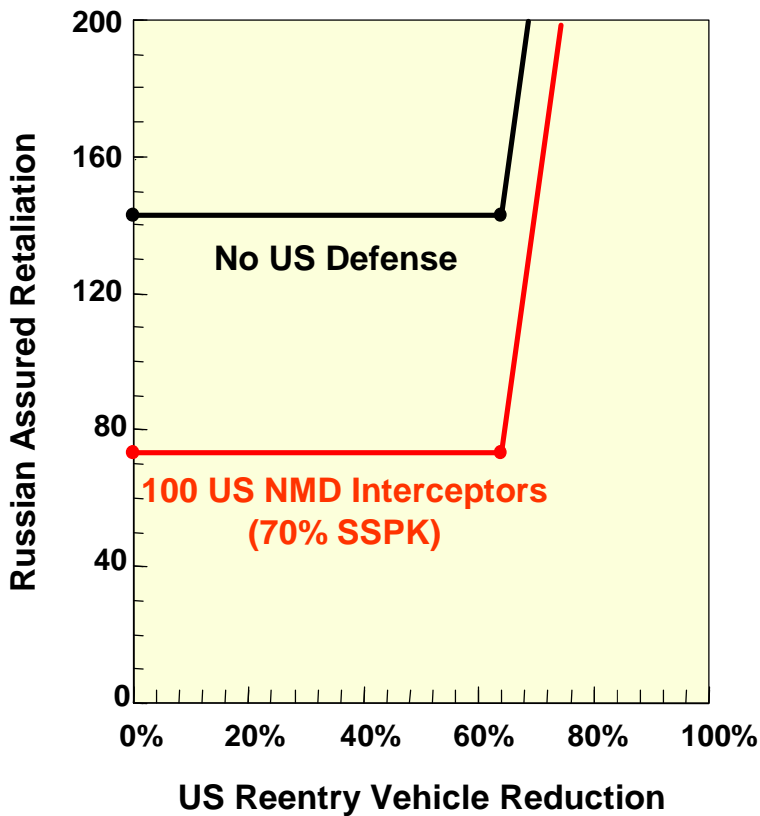
- US NMD harms Russian deterrence, thereby increasing Russian reliance on launch on tactical warning and early generation
- Either side can ameliorate the degradation in Russian assured retaliation due to US defenses
 - US can deploy defenses that minimize interceptor inventories
 - Russia can increase the day-to-day survivability of its strategic forces

US defenses harm Russian deterrence, but Russia can restore its deterrent by increasing the day-to-day survivability of its alert forces

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The Impact of Offensive Force Reductions



- Only extremely large offensive force reductions associated with US NMD deployments restore Russia's deterrent
 - This provides a rationale for Russian insistence on a very high offense-defense exchange ratio
- But at those deep cuts, the US deterrent is significantly diminished

Question 3: Does Freedom-to-Mix Ameliorate or Exacerbate the Harm to Deterrence and Stability?

- Russian vulnerable offensive forces are concentrated in relatively few targets
- US offensive forces need to be dramatically reduced (> 60%) before the survivability of Russian vulnerable forces increases

With moderate exchange ratios, US offensive reductions under FTM neither ameliorate nor exacerbate harm to deterrence and stability

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Policy Implications

- Consider a Freedom-to-Mix Treaty as an alternative to modifying the ABM Treaty
 - Ten-year duration
 - 1:1 exchange ratio
 - Russia's Moscow ABM interceptors count
 - Keep overall limit high enough to facilitate significant US ABM deployment
- Consider reserving sufficient “trade space” for defenses under START III
- Hedge against defenses being delayed or deficient

Next Steps

- Develop and assess candidate FTM treaties and offensive/defensive force structures
- Compare FTM with ABM Treaty modification and ABM Treaty withdrawal from both US and Russian perspectives
- Subject the FTM concept to criticism from the US arms control and policy communities